LOCKING TURN PIN

BACKGROUND OF THE INVENTION

1. Technical Field:

[0001] This invention relates generally to fasteners, and in particular fasteners for connecting two metal plates. Still more particularly, the present invention relates to a locking pin having a cam that expands a lower portion of an outer shell to lock the two metal plates together.

2. Description of the Related Art:

[0002] As with other mechanical, electrical and electro-mechanical devices, computers are made up of many components that need to be rigidly fastened together, in order to avoid the absurdity of a loose collection of parts lying in a pile. Components such as cases and frames are typically held together with welds, rivets and other permanent fasteners. Other components, particularly internal components, are held together with nonpermanent fasteners that permit the internal components to be removed and/or replaced.

[0003] Internal components such as processor boards, or board support structures, are typically mounted on racks inside the computer. Each rack has mounting flanges with a hole in each flange, as does a frame holding the processor board. To secure the processor board to the rack, a nonpermanent fastener is placed through the aligned holes in the mounting flange of the rack and the processor board, and then the nonpermanent fastener is tightened, thus holding the two flanges together. Examples of such nonpermanent fasteners are nuts and bolts, setscrews, and clips. A problem with nuts and bolts and setscrews is that they require tools to be fastened or removed. A problem with clips is that they are prone to loosen and/or fall out, and often are unable to provide a very tight connection.

[0004] Thus, there is a need for a nonpermanent fastener that can be used without any tools, to fasten parts, and particularly computer parts, together. The fastener should be able to provide a secure, tight and strong connection that does not loosen with vibration over time. Preferably,

the fastener should provide a "locked" position when securing two components together, and an "unlocked" position to remove the fastener. To avoid potential electrical shorting problems caused by the fastener being accidentally dropped onto electrical components in the computer, the nonpermanent fastener should be constructed of a material that is electrically non-conducting. The fastener should be color distinctive for both identification and location. The fastener should have a distinct marking visible to the user that indicates whether the fastener is in the locked or unlocked position. Finally, the fastener should provide a tactile and/or audible feedback indicating when the fastener is in the locked position.

SUMMARY OF THE INVENTION

[0005] As will be seen, the foregoing invention satisfies the foregoing needs and accomplishes additional objectives. Briefly described, the present invention provides a hand tightened locking pin using a unique internal cam configuration to lock the pin assembly.

[0006] The pin assembly includes a sleeve and a locking cam unit. The sleeve includes anti-rotation protrusions that match a keyhole in a first metal plate to prevent rotation of the sleeve. The pin assembly is inserted through the keyhole of the first metal plate and a circular hole in a second metal plate that lies on the first metal plate. When the locking cam unit, which is inside the sleeve, is rotated, a lower portion of the sleeve expands, locking the first and metal plates together. The cam is locked in position by concave shaped ends that mate over bulges in the lower portion of the sleeve. A locked/unlocked indicator on top of the pin assembly indicates when the concave shaped ends are mated with the bulges, thus locking the two metal plates together.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as the preferred modes of use, further objects and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

[0008] **Figure 1** depicts an interior or a computer housing;

[0009] **Figure 2a-b** illustrate lock indicators on a locking pin;

[0010] **Figures 3a-c** depict details of a processor board rack being connected to a case mounted bracket inside the computer housing;

[0011] **Figures 3d-e** illustrate details of a sleeve component of the locking pin;

[0012] **Figures 4a-b** depict additional detail of the sleeve and a locking cam unit that make up the locking pin;

[0013] **Figures 4c-d** illustrate additional detail of a rotation limiting pin and channel in the locking pin; and

[0014] **Figures 5a-b** depict additional detail of the locking pin in an unlocked (**Figure 5a**) and locked (**Figure 5b**) position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0015] Referring now to the drawing figures, in which like numerals indicate like elements or steps throughout the several views, the preferred embodiment of the present invention will be described. In general, the present invention provides an improved locking pin having an internal rotatable cam that expands a sleeve, thus locking two sheets of metal when the locking pin is inserted into holes in the sheets of metal and the internal rotatable cam is turned.

[0016] With reference now to **Figure 1**, there is depicted an interior of a computer housing **102**. Attached to the inside of computer housing **102** is a case mounted bracket **106**. A processor board rack **104**, designed to hold a processor board or support card/board (none shown), has a rack flange **110**, which mates up with a bracket flange **112** of case mounted bracket **106**. A feature of the present invention, a locking pin **108**, couples rack flange **110** to bracket flange **112**, thus attaching processor board rack **104** to case mounted bracket **106**. As will be seen in further detail below, locking pin **108** includes a sleeve **116**, in which a locking cam unit **114** is seated. As depicted in **Figure 1**, locking pins **108** are in a locked position (which will be discussed in greater detail below), thus firmly coupling the processor board rack **104** to case mounted bracket **106**.

[0017] Referring now to **Figure 2a**, additional detail of locking pin **108** is provided. As shown, locking pin **108** has a first locked indicator **202** and a second locked indicator **204**. When locking pin **108** is in a locked position, about which more is described below, first locked indicator **202** and second locked indicator **204** align as shown. When locking pin **108** is in an unlocked position, by rotating locking cam unit as shown in **Figure 2b** (either clockwise as shown or counterclockwise depending on the design of locking pin **108**), the first locked indicator **202** and second locked indicator **204** are no longer aligned. Accordingly, first locked indicator **202** and second locked indicator **204** provide a visual cue to a user indicating whether locking pin **108** is in a locked or unlocked position.

[0018] With reference now to **Figure 3a**, processor board rack **104** is shown being removed from case mounted bracket **106** when locking pins **108** are unlocked. Locking pins **108**, and in

particular expandable projections **308** are able to slide out of flange circular holes **302** when locking pins **108** are unlocked (allowing expandable projections **308** to be reduced in diameter, as described in further detail below).

[0019] In **Figure 3b**, a bracket keyed hole **304** is shown in rack flange **110**. As shown, bracket keyed hole **304** is shaped to prevent a rotation of sleeve **116**, for reasons described below. After processor board rack **104** is decoupled from case mounted bracket **106**, the unlocked locking pins **108** can be slid out of rack flanges **110** as shown.

[0020] **Figure 3c** provides additional detail of locking pin **108**, an in particular sleeve **116**. As illustrated in **Figure 3c** and in a cross-sectional view in **Figure 3d**, sleeve **116** has anti-rotation protrusions **306**, which mate in keyed hole ends **310** to prevent a rotation of sleeve **116** when locking cam unit **114** is rotated to lock or unlock locking pin **108**.

[0021] **Figure 3e** provides additional detail of sleeve **116** as it is inserted or removed through bracketed keyed hole **304** of rack flange **110**. As sleeve **116** is inserted or removed from rack flange **110**, expandable projection **308** is compressed, allowing expandable projection **308** to slide through bracket keyed hole **304**.

[0022] With reference now to **Figure 3f**, when sleeve **116** is fully inserted through bracket keyed hole **304** and flange circular hole **302**, expandable projection **308** expands, thus presenting a profile that is wider than flange circular hole **302** to lock sleeve **116** in, and to press rack flange **110** against bracket flange **112**.

[0023] Referring now to **Figure 4a**, an exploded view of locking pin **108**, including locking cam unit **114** and sleeve **116**. Note that in a preferred embodiment, sleeve **116** has a retention groove **402** inset into the interior face of a castled perimeter **418**. When locking cam unit **114** is inserted into sleeve **116**, a retention lip **404** on a cam unit disc **412** seats into retention groove **402**, preventing locking cam unit **114** from coming out of sleeve **116** during normal use of locking pin **108**.

[0024] A cam opening **426** passes through the center of sleeve **116**, which affords a passageway for cam **424** and a cam stem **428** to pass through to the interior portion of expandable projection **308**.

[0025] Note that cam **424** of locking cam unit **114** has an ellipse shape **408**, as shown in **Figure 4b**. Ellipse shape **408** is so shaped to lock the locking pin **108**, as described further in **Figures 5a-b**. Note also that ellipse shape **408** has concave ends **410**, which prevent locking pin **108** from unlocking, again as described in further detail below.

[0026] Referring to **Figure 4c**, a side view of cam unit disc **412** is depicted, to give additional detail of a rotation-limiting pin **414**. Rotation limiting pin **414** seats in a limiting channel **420**, shown in **Figure 4d**, which is inset in the mating side **422** of sleeve **116**. As shown, limiting channel **420** preferably subtends 90° of arc, thus allowing locking cam unit **114** to rotate 90° to lock or unlock locking pin **108**. Alternatively, rotation-limiting pin **414** can be attached to mating side **422** and limiting channel **420** can be inset into the underside of cam unit disc **412**.

[0027] With reference now to **Figure 5a**, locking pin **108** is illustrated in an unlocked position. As shown, in the unlocked position, cam **424** is oriented within an expandable opening **508** such that cam **424** does not press against expandable projection **308**. That is, when locking pin **108** is in the unlocked position, cam **424** does not press against a cylindrical portion **502**, a conical portion **504**, or a bullet nose **506** of expandable projection **308**. (Note that cylindrical portion **502** is preferably attached in a perpendicular orientation to a base **510** of sleeve **116**.) As such, expandable projection **308** retains a relatively narrow diameter, and does not push against an underside surface of rack flange **110** shown in **Figure 1**. Furthermore, in the non-expanded configuration, expandable projection **308** allows locking pin to be removed as described above in **Figure 3b**. Note that first locked indicator **202** and second locked indicator **204** are not aligned, thus indicating the locking pin is in the unlocked condition.

[0028] Referring now to **Figure 5b**, locking pin **108** is depicted in a locked position. In the locked position, cam **424** presses against the interior surface of expandable projection **308**,

primarily against the area where cylindrical portion **502** and conical portion **504** meet. This pressure causes the diameter of expandable projection **308** to expand, causing the exterior surface of expandable projection **308** to press against the underside surface of rack flange **110** shown in **Figure 1**, thus locking together the rack flange **110** and the bracket flange **112**. Note also the alignment of first locked indicator **202** and second locked indicator **204** indicating the locked condition of locking pin **108**.

[0029] Because of the configuration and fit of cam **424**, and particularly concave end **410**, against cam retaining bulge **406**, a tactile "snap" feedback is produced with locking pin **108** locks into the locked position. This "snap" feeling transmitted to the user gives a tactile indication, which augments the visual indication afforded by first locked indicator **202** aligning with second locked indicator **204**, that locking pin **108** is locked.

[0030] In a preferred embodiment, sleeve **116** is a first distinctive color, such as (but not exclusively) yellow, and locking cam unit **114** is a second distinctive color, such as (but not exclusively) blue. This distinctive color-coding provides two advantages. First, they allow the user to quickly spot where the locking pins **108** are located. Second, by being different colors, the user can clearly confirm that the sleeve **116** is not rotating when the locking cam unit **114** is being rotated during the locking or unlocking of locking pin **108**.

[0031] The present invention has been described in relation to particular embodiments that are intended in all respects to be illustrative rather than restrictive. Alternative embodiments will become apparent to those skilled in the art to which the present invention pertains without departing from its spirit and scope. For example, although the inventive locking pin has been depicted as securing a processor board rack, the locking pin is also useful in directly securing (fastening) a board or any similar mechanical support structure. Likewise, although the present invention has been described in accordance with use in attaching components inside a computer, it will be appreciated that the locking pin may be useful in any scenario in which a tight locking mechanism is required without the use of tools. Accordingly, the scope of the present invention is defined by the appended claims rather than the foregoing discussion.

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FIGURE COMPONENT LISTING

102	computer housing
104	processor board rack
106	case mounted bracket
108	locking pin
110	rack flange
112	bracket flange
114	locking cam unit
116	sleeve
202	first locked indicator
204	second locked indicator
302	flange circular hole
304	bracket keyed hole
306	anti-rotation protrusion
308	expandable projection
310	keyed hole ends
402	retention groove
404	retention lip
406	cam retaining bulge
408	ellipse shape
410	concave end
412	cam unit disc
414	rotation limiting pin
416	thumb grip
418	castled perimeter
420	limiting channel
422	mating side
424	cam
426	cam opening
428	cam stem
502	cylindrical portion
504	conical portion
506	bullet nose
508	expandable opening
510	base